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10 CFR Part 50

Policy Statement on Additional Applications of Leak-Before-Break Technology

AGENCY: Nuclear Regulatory Commission.

ACTION: Policy statement.

SUMMARY: The Nuclear Regulatory Commission (NRC) has at this time decided not to undertake rulemaking which would extend the scope of application of Leak-Before-Break (LBB) technology to emergency core cooling systems (ECCS) or environmental qualification (EQ) of safety-related electrical and mechanical equipment. Industry is encouraged to develop justification which would allow serious consideration of extension of the scope of application of LBB technology in the future. Use of exemptions with respect to the application of LBB to EQ continues to be permitted in accordance with the modification of General Design Criterion 4.

EFFECTIVE DATE: May 3, 1989.

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SUPPLEMENTARY INFORMATION:

Evaluation of Public Comment

On April 6, 1988 the NRC solicited public comment on the application of LBB to ECCS and EQ (53 FR 11311). Twenty-one effective comment letters were received. Twelve comment letters (from private citizens, citizens groups, regional coalitions and environmental groups) opposed the application of LBB to ECCS or EQ while eight comment letters (from utilities, a nuclear steam supply system vendor, industry groups and a nuclear fuel vendor) supported such an application. One nuclear steam supply system vendor took a neutral position.

Among those opposing, repeated citation was made to the Surry pipe rupture in December 1980, the March 1988 General Accounting Office report, "Action Needed to Ensure that Utilities Monitor and Repair Pipe Damage," the purported unreliability of ultrasonic testing to detect piping flaws and public statements made in August 1983 by the then Director of the Office of Nuclear Reactor Regulation (NRR) pertaining to intergranular stress corrosion cracking in BWR piping. The NRC has determined that none of these citations discredit either the present or proposed expanded scope of LBB. This is explained as follows: LBB acceptance criteria cannot be satisfied in the feedwater suction line which ruptured at Surry. There is no reason to expect LBB behavior in this line. The cited GAO report treated erosion/corrosion of piping. The factors which control erosion/corrosion are sufficiently understood so that the NRC can determine with confidence which piping systems are susceptible to erosion/corrosion. NRC acceptance criteria do not permit piping subject to erosion/corrosion to qualify for LBB. Difficulties with ultrasonic testing are irrelevant to LBB. Leakage detection with high margins is used instead to detect throughwall cracks in high energy piping during service. The statements made in August 1983 to the Commissioners by the then Director of NRR were made at a time when LBB had not advanced to its present state, and moreover were directed to BWR piping. Unless special materials or measures are employed, LBB cannot be applied to BWR piping because of intergranular stress corrosion cracking.

The nuclear steam supply system vendor that took a neutral position with respect to the application of LBB to EQ and ECCS recognized that limited safety and operational benefits could result. However, this vendor concluded that for plants utilizing its design comparable benefits could be obtained employing another recent rule change (as described below), and that "economic benefit * * * does not appear to be major, and net safety benefits may not outweigh the detriments."

Among those supporting the expanded use of LBB to EQ and ECCS, many economic, operating, testing, maintenance and design benefits were cited. The NRC remains firm in using safety benefits as the prime measure in deciding whether to divert limited resources to the research and rulemaking efforts needed to apply LBB to EQ and ECCS. A few safety benefits were identified in public comment. These are discussed as follows. The test and design requirement for fast starting of emergency diesel generators is derived from the double-ended guillotine rupture of reactor coolant loop piping when analyzed in accordance with 10 CFR 50.46 and Appendix K. The test requirement degrades bearings, gears, the governor and power transmission such that the propsect of reliable service from the emergency diesel generators could be diminished if pipe ruptures actually occur. Using LBB to postulate smaller pipe ruptures would lengthen the starting time and assist in preserving the reliability of the emergency diesel generators for some (but not all) plants. A second safety benefit deals with radiation embrittlement of the reactor pressure vessel. The relatively low peaking limits for the fuel which results from the currently required analyses might be increased in some plants when smaller LOCAs replace the double-ended guillotine break requirement. With higher peaking limits the fuel configuration can be redesigned to yield less radial fluence leakage. This can mitigate concerns with vessel life extension and pressurized thermal shock of the vessel. An additional safety benefit can be achieved by equipment reliability improvements (other than for the emergency diesel generators) resulting from fewer plant scrams and challenges due to lower ECCS set points and less harsh equipment qualification environments. However, reliability improvement due to lower ECCS set points and less harsh equipment qualification environments may be offset by safety degradations associated with such actions, particularly with respect to severe accident performance. It is presently uncertain that overall safety would improve when less harsh EQ profiles are specified or ECCS set points are reduced.

In large part, the first two safety benefits cited above can be obtained at this time more expeditiously and efficiently under the recent ECCS rule (53 FR 35996, September 16, 1988) which permits best estimate methodology with quantified uncertainty for evaluating LOCAs. The models needed for implementing the ECCS rule have undergone substantial development; however, research must be initiated to develop replacement design basis pipe ruptures when LBB is invoked for ECCS. Moreover, whereas the ECCS rule already exists in final form, the rulemaking needed to expand LBB technology would consume at least two years and considerable NRC effort. Finally, while the ECCS rule can be applied directly to all light water reactors (except one with stainless steel fuel cladding), LBB can be applied only to qualifying reactors. The scope of qualifying reactors is unclear; especially in question are BWRs.

With respect to harsh environments inside the containment, unless LBB can be successfully applied to main steam lines, harsh environments will not substantially change. Significant requirements will remain unless most of the large diameter piping inside the containment satisfy LBB requirements. Additionally, other breaches in the fluid system boundary, such as failed manways or valve bonnets, must be examined to determine whether they control EQ profiles. Reductions in EQ profiles are more readily achieved outside the containment because temperature, pressure and humidity do not build-up due to venting and blow out

panels in some cases. However, EQ profiles outside the containment attract lesser interest because the EQ profiles are usually less harsh and thus more easily satisfied.

A few commenters noted difficulties with cable insulation, seals and valve seats resulting from materials selected to resist harsh environments associated with the postulated double-ended guillotine pipe rupture. The NRC acknowledges these difficulties, but is not certain that reducing harsh environments would, on balance, increase safety. Additionally, it was suggested that the threat of pressurized thermal shock would be reduced by lower pumping set points for low pressure safety injection. The NRC does not accept this position because pressurized thermal shock is controlled by injection of cold water at relatively high pressure during a small break LOCA.

Policy Statement

Having considered all public comments received, the Commission has decided not to undertake any rulemaking to extend the applicability of LBB to ECCS or EQ at this time. In large part, any safety benefits associated with ECCS can presently be more readily obtained under the recent ECCS rule. The use of exemptions for applying LBB to environmental qualification was permitted in the revision to General Design Criterion 4 (52 FR 41288). This option continues to remain open.

Nonetheless, the Commission has decided to keep open an avenue for future consideration of rulemaking which would permit the application of LBB to ECCS and EQ. The Commission encourages industry to develop quantitative information that could justify the diversion of resources to the rulemaking efforts. Primary attention should be given to establishing an appropriate substitute or replacement for the double-ended pipe rupture used in ECCS and EQ evaluations. The Commission will consider modifying its current ECCS and EQ regulations when adequate technical justification supports the feasibility and benefits of the proposed modifications. In the interim, the Commission recognizes that situations may arise where justification can be developed by the industry for alternative ECCS and EQ requirements. Such justifications, if accepted by the Commission pursuant to the existing exemption process, would allow a limited number of case-by-case modifications to ECCS and EQ requirements. This could support future amendments to applicable requirements addressing ECCS and EQ.

Dated at Rockville, Maryland this 26th day of April 1989.

For the Nuclear Regulatory Commission.

Samuel J. Chilk,

Secretary of the Commission.